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OCEAN DATA SYSTEMS, INC.
6000 EXECUTIVE BLVD., ROCKVILLE, MARYLAND 20852 • 301/881-3031

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LEVEL II

Prepared For:

OFFICE OF NAVAL RESEARCH
ARLINGTON, VIRGINIA

(6) ASEPS NEAR FIELD TRANSMISSION LOSS MODIFICATION

P-2205.

(11) 1 Apr 1974

(15) N00014-73-C-0131 (12) 45

N00014 73 C 0131

Submitted By:

OCEAN DATA SYSTEMS, INC.
ROCKVILLE, MARYLAND

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OCEAN DATA SYSTEMS, INC.
6000 EXECUTIVE BLVD., ROCKVILLE, MARYLAND 20852 • 301/881-3031

April 2, 1974

LCDR T. J. McCloskey, USN
Manager, Acoustic Prediction
Long Range Acoustic Propagation Project
Office of Naval Research
Code 102-OS
Department of the Navy
Arlington, Virginia 22217

Dear LCDR McCloskey:

Ocean Data Systems, Inc. is pleased to submit this unsolicited proposal No. P-2205 to the Office of Naval Research for modifications to ASEPS and FACT to allow for the effects of sloping bottoms in the vicinity of the sonar on propagation loss values ($15,783).

This offer may be considered valid for a period of 90 days. We will be happy to discuss any aspect of this proposal and provide any additional information you may require.

Sincerely,

OCEAN DATA SYSTEMS, INC.

Edward Morenoff

Edward Morenoff, Sc.D.
Senior Vice President

EM:rm

Attachment

NOTICE

"This data furnished in Ocean Data Systems, Inc. unsolicited Proposal No. P-2205 to the Long Range Acoustic Propagation Project, Office of Naval Research for modifications to ASEPS and FACT to incorporate the effects of sloping bottoms on transmission loss shall not be disclosed outside the Government or be duplicated, used or disclosed in whole or in part for any purpose other than to evaluate this proposal; provided, that if a contract is awarded to this offeror as a result of or in connection with the submission of such data, the Government shall have the right to duplicate, use or disclose this data, to the extent provided in the contract. The restriction does not limit the Government's right to use information contained in such data if it is obtained from another source without restriction."

This restriction applies to the entire proposal submitted herein by Ocean Data Systems, Inc.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

I. INTRODUCTION

Ocean Data Systems, Inc. is pleased to submit this unsolicited proposal No. P-2205 to the Office of Naval Research for upgrading the ASEPS model. The objective is to introduce the effects of sloping bottoms in the vicinity of the sonar on propagation loss.

ODSI is uniquely qualified to perform the work of these tasks because of its extensive prior experience in building, modifying and documenting acoustic modeling systems for the Office of Naval Research. In particular, ODSI has participated in the development modification and application of the following acoustic models and systems: ASEPS, NISSM II, TASSRAP, SHARPS, ASRAP, FACT, RP70, SUBRAP, SURVRAP, IOMEDX, ASW Assessment and NEAT.

Dr. Edward Morenoff, Vice President, Computer Systems, has been selected to direct the proposed effort. Dr. Morenoff's comprehensive knowledge of acoustic models is based, in part on the work he performed under Contract No. N66314-70-C-0289 requiring the analysis of the execution of all oceanographic models at the U. S. Navy Fleet Numerical Weather Central and how this might be improved. Dr. Morenoff was project director of work performed under Contract No. N66314-71-C-0778 leading towards improving the operating efficiency and performance characteristics of the Long Range Propagation Loss Model

(RP70), and Contract No. N66314-71-C-2817 for the analysis of ambient noise computations in three existing underwater acoustic propagation loss models and the synthesis of the most desirable features of each into a new combined model. Finally, Dr. Morenoff was project leader of work performed under Contract No. N00014-72-C-0291 which led to substantive improvements to the SHARPS, ASRAP, and SUBRAP models, the development of the TASSRAP model and the implementation of programs in support of Navy requirements such as those defined for NEAT, ASW Assessment and SURVRAP. Dr. Morenoff is currently project leader for Contract No. N00014-73-C-0131 providing LRAPP model development and support functions for the Office of Naval Research. Dr. Morenoff will be aided in the performance of the proposed work by Captain Paul Wolff and Mr. Kenneth Osborne.

Captain Wolff (U.S.N., Ret.) has had a distinguished career as an environmental scientist which has included pioneering efforts in the field of atmospheric/oceanic systems, the application of numerical methods and computer technology for modeling their physical characteristics, analyzing their past activity and predicting their future behavior. His twenty-nine years of professional experience have been filled with significant scientific achievements, publication of numerous technical papers and successively more responsible positions in the meteorological and oceanographic communities.

As a Captain in the U. S. Navy, Paul Wolff most recently was the Office of Naval Research Liaison Officer at the U. S. Naval Postgraduate School, responsible for the development and application of underwater acoustic models and the interpretation of the results of their execution. Immediately prior to that assignment, he served as Commanding Officer, Fleet Numerical Weather Central from 1968 through 1970.

Captain Wolff's most notable contributions include his development and reduction to practice of underwater sound propagation models incorporating environmental effects; his role in the development of a world-wide computer network for the collection of meteorological and oceanographic data, its subsequent analysis and the timely distribution of numerically generated environmental products; his establishment of an operational oceanographic data center; his organization of the first hemisphere-wide synoptic oceanographic observation effort coordinating U. S. and foreign Naval and commercial vessels as ships of opportunity; and his development of numerical synoptic oceanographic analysis/forecasting models on hemispheric and smaller-scale bases treating the atmosphere and ocean as a coupled system - the first of its kind in the world.

Mr. Kenneth Osborne has played a leading role in the data reduction function associated with the evaluation of the TASSRAP model and subsequently developed the mathematics for the geometry which provided the generalized applicability of the

TASSRAP model on a world-wide basis. He incorporated these geometrical concepts into the SURVRAP project which resulted in the initial development of the ASEPS model.

Section II, Technical Approach, describes how ODSI intends to realize the goals of the proposed effort. Section III, Project Management, presents proposed manpower, performance and cost schedules for the contractual effort. Sections IV and V discuss Relevant Corporate Experience and Corporate Capabilities, respectively. Finally, Section VI, Personnel Resumes, elaborates on the background and experience of the project personnel.

II. TECHNICAL APPROACH

At present, the ASEPS model obtains transmission loss values using an extension of the FACT model which assumes a flat bottom close to the receiver and a variable bottom far-field from the array. Far-field data are kept in tables containing the bottom depth, the water mass conjugate depth, and the bottom loss type. Since it is frequently the case that ASEPS is to be used in areas not having a flat bottom in the vicinity of the receiver, ODSI proposes to modify the ASEPS/FACT model to permit the bottom to slope in the near-field. The work will be done in two parts.

The first part inserts modifications into FACT, the primary transmission loss module. This incorporates the array near-field slope characteristics due to the modified arrival structure angles into the basic transmission loss values. The second part is concerned with the incorporation into ASEPS of the additional FACT capability.

The specific proposed FACT modification uses a slope description at the array. Three bathymetric conditions which will be handled separately include:

(1) UP-SLOPE INCIDENT PROPAGATION

(2) DOWN-SLOPE INCIDENT PROPAGATION

(3) NEAR-FLAT BOTTOM PROPAGATION

Depending upon the slope condition, transmission loss values will be modified by means of either limiting or of image enhancing the arrival structure angles. These specific proposed changes to the basic FACT model are not expected to increase appreciably the module's execution time requirements.

ASEPS will be then modified to reflect improved array characteristics. These ASEPS modifications include items such as memory reallocation for the increased transmission loss vectors, the transmission loss model changes for direction dependent FACT table look-up efforts, the library access of slope characteristics for each array, and the data flow restructures associated with the directionally dependent calls to FACT. These modifications will affect both the SIGNAL model and the NOISE model in ASEPS. The initial ASEPS model proposed configuration will allow for up to eight near-field sectors (slope conditions) for each array. These sector boundaries will be constructed to be bounded by 5-degree resolution relative to the array orientation, but with variable width.

In order to determine the validity of the proposed model modifications, the modified FACT model computations will be compared for at least two cases with available measured transmission loss data for conditions which reflect near-field bathymetry effects. This proposed task includes the installation of the upgraded ASEPS model on the CDC 6500 at FNWC and on the

Univac 1108 at NUC. The upgraded model will be available for evaluation of the near-field bathymetry modification upon completion of this task.

III. PROJECT MANAGEMENT

The proposed ODSI Project Team, under the direction of Dr. Edward Morenoff, is identified in Figure III-1. Captain Paul Wolff will lead the effort. Mr. Kenneth Osborne is the deputy leader.

Figure III-2 is an exhibit of the projected allocation of professional and technical manpower during the contractual effort. This effort is shown as task man-months for the duration of the project. Figure III-3 is an exhibit of the major project milestones. Completion dates are determined from start of contract.

The cost schedule is shown in Figure III-4. Each task is separately priced on the same basis as the task efforts being performed under Contract No. N00014-73-C-0131. Captain Wolff is shown as a Senior Systems Scientist. Messrs. Osborne and Weyland are Senior Systems Programmers. Mr. Yogi is a Systems Analyst. Mr. Ryan is a Programmer.

The cost schedule is based on the assumption that computer time as required for the performance of each of the tasks will be made available to ODSI as Government Furnished Equipment (GFE).

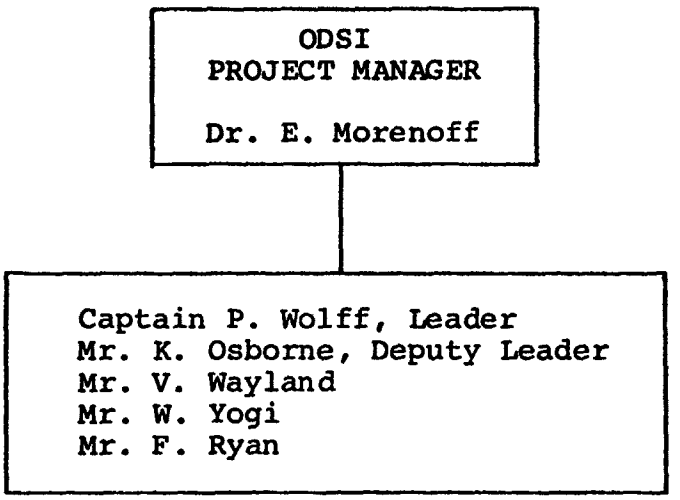

FIGURE III-1: ODSI PROJECT TEAM

TASK / MONTH	1	2	3	TOTAL
ASEPS NEAR FIELD	.5	1.5	1.5	3.5

FIGURE III-2: MANPOWER ALLOCATION BY TASK

(In Man-Months)

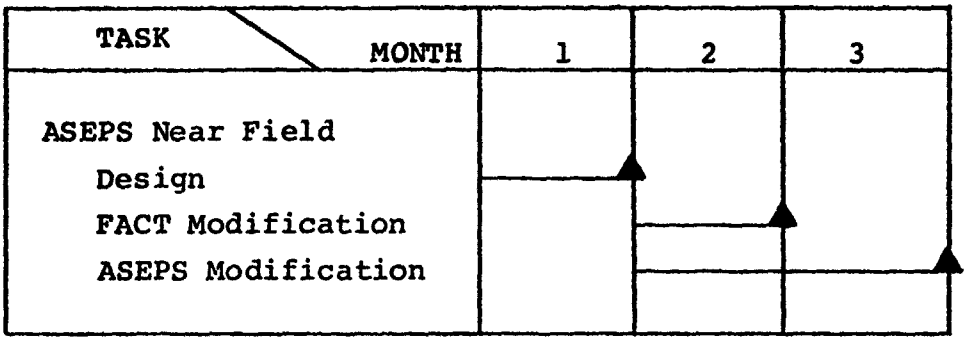

FIGURE III-3: PROJECT MILESTONES

FIGURE III-4: COST SCHEDULE

A. Personnel

Sr. Systems Scientist	0.5mm @ $4853/mm	$ 2,426
Sr. Systems Programmer	2.0mm @ $3900/mm	$ 7,800
Systems Analyst	0.5mm @ $3467/mm	$ 1,734
Programmer	0.5mm @ $3033/mm	$ 1,516
	Personnel Total	$13,476

B. Travel

3 R/T Coach - D.C./Monterey @ $375/trip	$ 1,125
3 R/T Coach - Monterey/San Diego @ $74/trip	$ 222
20 Days Per Diem @ $30/Day	$ 600
20 Days Car Rental @ $18/Day	$ 360
Travel Total	$ 2,307
Total	$15,783

Note 1: Each man-month is comprised of 173.33 man-hours.

Note 2: The hourly rates for each labor category shown are as follows:

Sr. Systems Scientist	$28/hr.
Sr. Systems Programmer	$22.50/hr.
Systems Analyst	$20/hr.
Programmer	$17.50/hr.

IV. RELEVANT CORPORATE EXPERIENCE

As a corporation, ODSI has established a solid record of achievement in the successful completion of projects which have been undertaken. Many of these projects are relevant to the subject procurement, as a consequence of the nature of the work involved. In this Section examples are cited, together with a brief description of the work performed and points of contact within the client's organization who can provide information to permit evaluation of the quality of the work performed.

U. S. Navy Office of Naval Research
(Contact: LCDR T. McCloskey, U. S. N., Manager LRAPP Acoustic Prediction Program, Telephone No. 301/767-2843).
Under Contract N00014-72-C-0147, ODSI restructured and partially recoded the SHARPS II Range Prediction Model to facilitate its operational utilization. The effort resulted in an 83% reduction in the elapsed time on a per location basis from approximately 30 seconds to 5.1 seconds. A Counter Detection (CD) prediction capability identifying the maximum range at which a target could hear the searching of designated Sonars was devised for the model. Finally, the sensitivity of the operational Automated Ambient Noise Model was investigated with respect to variations of selected loss values and specified distances.

U. S. Navy Office of Naval Research
(Contact: LCDR T. McCloskey, U. S. N., Manager LRAPP Acoustic Prediction Program, Telephone No. 301/767-2843).
Under Contract N00014-72-C-0291, ODSI has performed a number of tasks. These have included, but are not limited, to the following: modifications to the ASRAP model to include the quarter ray trace and quarter ray recursion capability, the use of critical angles for starting rays and for special bottom rays,

and the variation of range increments as a function of distance from the source; the development of TASSRAP, a model to provide range prediction for the ITASS towed array, including modifications to ASRAP and the FNWC automated ambient noise model; the adaptation of ASRAP to the UNIVAC 642 computer system; the provision of plot programs for the NISSM reverberation and propagation loss models and the BELL transmission loss ambient noise models in connection with an ASW assessment requirement; and the model modifications and operation in connection with the SURVRAP requirements.

U. S. Navy Office of Naval Research
(Contact: LCDR T. McCloskey U. S. N., Manager LRAPP Acoustic Prediction Program, Telephone No. 301/767-2843).
Under Contract N00014-73-C-0131, ODSI performed a number of tasks. These have included but are not limited to the: aided in the establishment of computational and remote terminal requirements for the Acoustic Environmental Support Detachment; adapted and upgraded the FACT Transmission Loss, Noise and Arrival Models to operate on the CDC 6000 series computers, developed a worldwide version of the TASSRAP Model; continued support work on SURVRAP and AWS assessment; and installation of ICAPS/TASDA on the U. S. S. Kitty Hawk.

U. S. Navy Fleet Numerical Weather Central
(Contact: Captain Samuel Houston, U.S.N., Commanding Officer, Telephone No. 408/646-2141).
Under Contract N66314-70-C-5156, ODSI performed three distinct tasks. The first task dealt with improving the accuracy of an anti-submarine warfare forecast model and involved the modification of existing computer programs and the design and implementation of new programs. All programs were developed in FORTRAN for operation on the CDC 6500 under the SCOPE operating system. New programs implemented included special plot programs to produce computer drawn plots of expendable bathythermograph data on a Varian Plotter connected to the CDC 6500. Task Two dealt with SCOPE level investigations and modifications. First, analytic programs were developed for use in obtaining information concerning the usage of certain CDC 6500

system components (namely, peripheral processors, extended core storage and central memory) and the interactions associated with their concurrent usage. Second, the CDC 6500 disk input/output facility was modified with the goal of making it more efficient, capable of further upgrading with reasonable ease, and to pave the way for ultimate development of a full-tract driver. This effort included splitting the Stack Processor into 2 programs capable of operation in separate peripheral processors. Task Three was concerned with incorporating a restart capability in the FNWC Atmospheric Primitive Equation Prediction Model which limited the real time loss in the event of any type failure to an operationally acceptable upper bound of 10 minutes and rewriting selected frequently used subroutines in very efficient COMPASS level code to take full advantage of the CDC 6500 hardware environment.

U. S. Navy Fleet Numerical Weather Central

(Contact: Captain Samuel Houston, U.S.N., Commanding Officer, Telephone No. 408/646-2141). Under Contract N66314-70-C-0778, ODSI developed and implemented techniques leading to the improvement of the operating efficiency and performance characteristics of the existing FNWC Acoustic Propagation Loss Model. As part of this effort, a new mechanism was formulated for computing the sine of an angle, which when implemented in COMPASS, was significantly faster than the standard CDC library square root routine. Also, programs were developed to generalize the Model's output chart generation mechanisms with respect to plotting, scaling and grid line construction.

U. S. Navy Fleet Numerical Weather Central

(Contact: Captain Samuel Houston, U.S.N., Commanding Officer, Telephone No. 408/646-2141). Under Contract N66314-71-C-1653, Task 2, ODSI participated in the design and implementation of procedures for monitoring and controlling the use and allocation of computer resources by the FNWC CDC66500 computer users. In particular, ODSI supplied the programs which generate the authorized allocation rate table, analyze SCOPE generated Dayfile records to determine resource usage, compare actual to authorized resource usage, and present the results in tabular and histogram form. Programs were written in FORTRAN and COMPASS. Under Task 1 of the same contract, ODSI repartitioned an existing four processor version of the FNWC atmospheric prediction model on the basis of

horizontal domain, rather than computational burden considerations. The repartitioning of the model resulted in a reduction of elapsed execution time for a seventy-two hour prediction run from two hours to approximately seventy-two minutes.

U. S. Navy Fleet Numerical Weather Central
(Contact: Captain Samuel Houston, U.S.N., Commanding Officer, Telephone No. 408/646-2141). Under Contract N66314-72-C-1372, ODSI developed a two processor version of the Navy Atmospheric Primitive Equation Model, partitioned on the basis of horizontal domain equations. The two processor version of the Model is employed principally to provide operational back-up for the operational four processor version of the Model at FNWC and as a research and development tool.

V. CORPORATE CAPABILITIES

Ocean Data Systems, Inc. (ODSI) was initially formed in 1969 to meet the spiraling data and information needs of the ocean science community. The scope of ODSI activities has been significantly extended through the formulation of wholly-owned subsidiaries and the addition of a highly skilled inter-disciplinary professional staff. ODSI is now also providing advanced management and information services to meet human, social and economic needs in fields ranging from ecological analysis and environmental planning to drug abuse control and the development of information systems for financial institutions such as insurance companies and stock brokers.

The Company has gained recognition as a profit-oriented "high technology" corporation, blending together a unique corps of specialists in such diverse fields as computer science, ocean technology, resource management, systems analysis and jurisprudence with the primary goal of offering a broad spectrum of services to organize information accurately, rapidly, and in useful form to satisfy the requirements of a wide variety of public and private interests. Corporate strategy has been to assemble and bring to bear a concentration of expert talent to solve problems either conceptually difficult or requiring resolution within severe time constraints.

The President of ODSI is Dr. Jerome Morenoff. Dr. Morenoff has a distinguished record of achievement in both computer science and international legal affairs. He has

served in the executive Office of the President as a computer specialist and his experience includes executive positions with several data processing companies. Dr. Morenoff is responsible for establishing corporate policy and directing all corporate operations. The Executive Vice President is Donald L. Roth, Esquire. Mr. Roth served as Trail Attorney for the Securities and Exchange Commission and thereafter was engaged in a prominent practice in financial and corporate law. At ODSI, Mr. Roth is responsible for financial, administrative and legal affairs and those of its subsidiaries. In addition, he directs the Company's programs of growth by both internally funded expansion into new business areas and the merger or acquisition of other firms. Dr. Edward Morenoff is Vice President, Computer Systems. He is recognized as an expert in the field of data base file management systems, computer program transferability and standardization, and modular programming. Dr. Morenoff has primary management responsibility for the application of computer hardware and software systems to meet the needs of ODSI's government and industrial clients.

ODSI has established an enviable record of success during its five years of operations and has increased its staff from the three initial founders to more than eighty professional employees. Revenues for ODSI's fiscal year ending June 30, 1973 were approximately 2 million dollars with a pre-tax profit of $200,000 representing an increase of more

than 100% in both volume and profit from the preceding year. ODSI expects to do in excess of 3 million dollars in sales during the current fiscal year.

The Company's books have been audited since inception by Messrs. Coopers and Lybrand. ODSI's accounting records have also frequently been examined by the Federal Government both in connection with pre-award surveys and the approval of invoices for payment. No difficulties have ever been experienced in connection with such examinations.

On the basis of the technical and management strengths of ODSI's founding principals, substantial equity financing has been obtained through the agency of a leading investment banking firm. Among the prominent institutional investors owning substantial amounts of ODSI common stock are Bankers Trust Company of New York and State Farm Mutual Automobile Insurance Company. As of June 30, 1973, ODSI's stockholder equity was in excess of $750,000. Further, an unsecured line of credit in the amount of $250,000 has been extended to ODSI by First National Bank of Maryland. However, due to ODSI's ample cash resources and satisfactory performance and collection experience, borrowing has not been necessary to any great extent to finance performance.

VI. PERSONNEL RESUMES

DR. EDWARD MORENOFF

CAPTAIN PAUL WOLFF

KENNETH R. OSBORNE

VINCENT WAYLAND

WARREN S. YOGI

FRANK J. RYAN

EDWARD MORENOFF
Senior Vice President

EDUCATION

Doctor of Computer Science (Sc.D.) 1969
The George Washington University

Master of Science, Electrical Engineering 1958
Columbia University

Bachelor of Science, Electrical Engineering 1957
Columbia University

Bachelor of Arts, Mathematics 1956
Columbia College

PATENTS

Method and Apparatus for Storage and Selective Retrieval of Magnetic Recorded Data, U. S. Patent No. 3,229,877, January 1966

Method and System for Program Linkage and Communication Mechanism for Computers. U. S. Patent No. 3,564,504, February 1971

PROFESSIONAL EXPERIENCE

Dr. Morenoff is nationally recognized in computer science and technology. His 15 years of professional experience in the design and implementation of computer systems have provided him with a comprehensive understanding of computer hardware and software applications. He has published numerous papers concerning file management systems and computer program transferability.

Ocean Data Systems, Inc., Rockville, Maryland, 1969 - Present

Dr. Morenoff is Vice President for Computer Systems. He has primary management responsibility for the application of computer hardware and software systems to meet the needs of the scientific community. One major project is the development of a proprietary family of general purpose file management systems, distinguished by their high degree of insensitivity to changes to computer hardware configurations, data format and structure, and computer programs.

Dr. Morenoff developed for the Fleet Numerical Weather Central a partition synchronization mechanization employed in the four-part partition of the Kesel-Winninghoff Primitive Equation Atmospheric Prediction Mode. The mechanism allows the model to operate in a four processor mode to take advantage of the equation set's mathematical parallelism

and the FNWC's two dual processor CDC 6500 computer systems. He has also analyzed the operations of the FNWC computer facility, developed a set of recommendations as to how overall system performance and efficiency could be improved, and contributed to improving the performance characteristics of the FNWC Underwater Sound Propagation Loss Model.

Dr. Morenoff performed a preliminary study for the National Oceanographic and Atmospheric Agency leading to the integration and inter-connection of the two CDC 6600 Computer Division computers with the computers operated by the National Meterological Center and the National Environmental Satellite Center. In addition, he was a principal investigator in the analysis of the requirements for automation of the Special Testing and Research Laboratory of the Bureau of Narcotics and Dangerous Drugs and for a Laboratory Spectra Retrieval System in support of the Bureau's chemists. He also performed an analysis of the automation requirements of the back office operations of a brokerage firm and of the computer system performance for a wholesale grocery operation.

Rome Air Development Center, Rome, New York, 1958 - 1969

Dr. Morenoff, while serving on the Technical Staff of the Rome Air Development Center (USAF), was stationed in Washington, D.C. He contributed to the definition and formulation of projects in information processing of potential long range value to the U.S. Air Force. One of the most significant projects was the investigation of techniques by which computer software programs could be transferred from one arbitrary operating environment to another with little, if any, additional cost in time or money. During this period, Dr. Morenoff also provided consulting services to various Department of Defense organizations, including the Office of the Secretary of Defense.

Preceding his assignment in Washington, D.C. Dr. Morenoff served as special assistant to the Chief, Information Processing Laboratory, Rome Air Development Center. In that capacity, he provided technical consulting services to staff engineers related to information data handling. He was also responsible for advanced plans and programs for the Center's computer facility.

A principal feature of the computer system designed by Dr. Morenoff for the facility was its ability to share a common pool of high capability, auxiliary storage devices and peripheral equipments among several computers, thus minimizing overall costs involved in providing multiple

equipment for each computer and improving total system reliability and availability. The pool included such diverse hardware as query/response consoles, optical print readers, and random access mass storage devices.

Dr. Morenoff's experience in developing information systems began in 1958. As an Air Force Lieutenant, he served as a project officer responsible for both the Aerospace Intelligence Data System and the ground data processing subsystem for a space reconnaissance project. In the former position, he was involved in initial work on what later became the IBM Formatted File System. Later, as a civilian employee of the Air Force, he led a team in the design of an information processing capability for a completely-militarized, highly-interactive, limited war intelligence data reduction complex. This was followed by the design of an automated storage and retrieval system for the Air Force Reliability Control Data Bank Project. On the basis of this experience, Dr. Morenoff became committed to the basic principles of generalized data management systems, and the need for them in an expanding computer technology.

Ford Instrument Company, Long Island City, New York, 1957 - 1958

Technical Staff Engineer (Summer 1958)

In this capacity, Dr. Morenoff was a member of a specially organized team charged with the design and fabrication of a model of a special purpose digital computer for use with a missile system being developed for the U.S. Army, within a four-month period. His responsibilities included the development of an accurate digital clock, system power supplies and inter-communications links, and assisting in the logical design of the computer's central processing unit.

Technical Staff Engineer (Summer 1957)

Dr. Morenoff participated in a comparative evaluation of computer techniques applied to an airborne navigational system. He was responsible for the investigation of the application of standard digital techniques towards this end. His investigation consisted of designing such a navigational computer, with special emphasis on the problems of size, speed, accuracy and efficiency. The investigation was completed within the allotted time period and the resulting design was selected by company management as the most efficient approach to the problem under consideration.

PUBLICATIONS

"Integrated Three-Dimensional Atmospheric and Oceanic Model Development" (co-author), Institute of Electrical and Electronic Engineers International Convention and Exposition, Session 11, The Evolution of Large Government Computing Systems, New York, New York, March 1973.

"The Navy's Operational Four Processor Atmospheric Prediction Model" (co-author), ARPA/NASA Symposium Programming for ILLIAC IV, Monterey, California, March 1972

"DBM: Data Base Manager", ACM 10th Annual Technical Symposium, Washington, D.C. Chapter, June 1971

"Four-Way Parallel Processor Partition of an Atmospheric Equation Prediction Model" (co-author), Proceedings of the AFIPS 1971 Spring Joint Computer Conference, AFIPS Press, May 1971

"Marine Information Systems, What We Have, What We Need", Oceanology International, Vol. 6, No. 2, February 1971, pp. 34-36

"Marine Data File Management", Proceedings of the Sixth Annual Conference of the Marine Technology Society, 1970, Marine Technology Society, Vol. 1, June 1970, pp. 189-198

"The Transferability of Computer Programs and the Data on Which They Operate", Proceedings of the AFIPS 1969 Spring Joint Computer Conference, Thompson Book Company, April 1969, pp. 609-610

"Table Driven Augmented Programming Environment: A General Purpose User-Oriented Program for Extending the Capabilities of Computer Operating Systems", Doctoral Dissertatuib, George Washington University, December 1968

"Program String Structures: A Building Block Approach for Implementing Computer Programs", Operations Research Society of America, Space Sciences Section Symposium, December 1968

Program Transferability Study Group Report (co-author), Rome Air Development Center Technical Report 68-341, November 1968

"Program String Structures and Modular Programming" (co-author), Proceedings of First National Symposium on Modular Programming, Information and Systems Press, July 1968

"Program String Structures and Coherent Programming", Coherent Programming Seminar, Massachusetts Institute of Technology, Lincoln Laboratories, March 1968

"An Approach to Standardizing Computer Systems" (co-author), Proceedings 22nd National ACM Conference, Thompson Book Company, August 1967, pp. 527-537

"Applications of Generalized Data Management Systems", AFIPS Spring Joint Computer Conference Data Management Panel, April 1967

"Inter-Program Communications, Program String Structures and Buffer Files" (co-author), Proceedings of AFIPS 1967 Spring Joint Computer Conference, Thompson Book Company, April 1967, pp. 175-184

"On the Standardization of Computer Systems" (co-author) Rome Air Development Center Technical Report 67-165, April 1967

"The Application of Level Changing to a Multilevel Storage Organization" (co-author), Communications of the ACM, 10, 3, March 1967

"A Code for Non-Numeric Information Processing Applications in On-Line Systems" (co-author), Communications of the ACM, 10, 1, January 1967, pp. 19-22

"Design of a Program Linkage and Communication Mechanism for the GE 635 Computer System" (co-author), Rome Air Development Center Technical Report 66-726, January 1967

"Job Linkages and Program Strings" (co-author), Rome Air Development Center Technical Report 66-142, April 1966

"Level Changing and Multilevel Store", Communications-based Information Systems Symposium, December 1965

"Classifier: An Automated Computer-Oriented Information Classification System", Proceedings of the American Documentation Institute Annual Conference, Cleaner-Hume Press, October 1964, pp. 411-420

"IPC: A Code Character Set for Information Processing" (co-author), Rome Air Development Center Technical Report 64-426, October 1964

"Theory of a Multiple Tape Queuing System and its Applications to Electronic Systems" (co-author), Rome Air Development Center Technical Report 62-167, May 1962

AWARDS AND HONORS

William Petit Trowbridge Fellow in Engineering, Columbia University, 1957-1958

Tau Beta Pi (Engineering Honor Society)

Eta Kappa Nu (Electrical Engineering Honor Society)

PROFESSIONAL AFFILIATIONS

Association for Computing Machinery
Institute for Electrical and Electronic Engineers
Professional Group Membership:
Systems Science and Cybernetics
Electronic Computers;
Computer Group Representative
on IEEE Oceanography
Coordinating Committee
Society of Naval Architects and Marine Engineer's
Marine Resources Exploration Systems Committee
Marine Technology Society
Chairman, Marine Information Systems Committee
Member, Marine Mineral Resources Committee
National Academy of Engineering
Member, Marine Engineering Information & Data
Exchange Panel of the Marine Board

PAUL M. WOLFF

Vice President

EDUCATION

Doctoral work, Numerical Meteorology U.S. Naval Postgraduate School	1959-1963
Graduate work, Meteorology and Mathematics University of Chicago	1951-1952
Master of Science and Meteorology U.S. Naval Postgraduate School	1949
Graduate work, Meteorology and Mathematics University of Chicago	1942-1943
Bachelor of Arts, Mathematics and Physics Wittenberg University	1942

PROFESSIONAL EXPERIENCE

Captain Wolff (U.S.N., Ret.) has had a distinguished career as an environmental scientist which has included pioneering efforts in the field of atmospheric/oceanic systems, the application of numerical methods and computer technology for modeling their physical characteristics, analyzing their past activity and predicting their future behavior. His twenty-nine years of professional experience have been filled with significant scientific achievements, publication of numerous technical papers and successively more responsible positions in the meteorological and oceanographic communities.

Ocean Data Systems, Inc., Monterey, California, 1972-present

As Vice President, Capt. Wolff participates in the formulation of corporate policy and overall management of technical projects. He has responsibility for corporate activities to satisfy the atmospheric and oceanographic analysis and forecasting requirements of the marine science community. He is the corporate officer headquartered in Monterey, California.

Captain Wolff is currently a member of the: Joint IOC/WMO Group of Experts on IGOSS Technical Systems Design; WMO Commission on Maritime Meteorology Working Group on Marine Meteorological Services System; and the Joint IOC/WMO IRES Working Group on Observational Strategy.

U.S. Navy, 1942 - 1972

As a Captain in the U.S. Navy, Paul Wolff most recently was the Office of Naval Research Liaison Officer at the U.S. Naval Postgraduate School, responsible for the development and application of underwater acoustic models and the interpretation of the results of their execution. Immediately prior to that assignment, he served as Commanding Officer, Fleet Numerical Weather Central from 1968 through 1970 and as Officer in Charge, Fleet Numerical Weather Facility from 1961 through 1968. From 1958 through 1960 he served as Officer in Charge, Navy Numerical Weather Project. In 1957 he served as a member of the Joint Numerical Weather Prediction Unit. Capt. Wolff's career also includes duty tours as Director of Micrometeorology at Sea during 1956 and Meteorologist for Carrier Division One from 1954 through 1956. Both during and immediately following World War II he served as meteorologist aboard nine Naval ships.

Capt. Wolff's most notable contributions include: His investigation, while associated with Project AROWA, of wave behavior in the 500 mb level and block formation, the relations between 500 mb and surface systems, cyclogenesis and the adaptation of the results to practical forecasting, where they are still in use; his development and reduction to practice of underwater sound propagation models incorporating environmental effects; his role in the development of a world-wide computer network for the collection of meteorological and oceanographic data, its subsequent analysis and the timely distribution of numerically generated environmental products; his establishment of an operational oceanographic data center; his organization of the first hemisphere-wide synoptic oceanographic observation effort coordinating U.S. and foreign Naval and commercial vessels as ships of opportunity; and his development of numerical synoptic oceanographic analysis/forecasting models on hemispheric and smaller-scale bases treating the atmosphere and ocean as a coupled system - the first of its kind in the world.

PUBLICATIONS

"Investigation and Prediction of Dispersion of Pollutants in the Sea with Hydrodynamical Numerical Models" (co-author) FAO Technical Conference on Marine Pollution and its Effects on Living Resources and Fishing, Rome, Italy, 1970.

"Environmental Forecasting - Largest Marine Information Systems", Marine Technology Society Journal, Vol. 4, No. 6, Nov.-Dec. 1970, pp. 7-18.

"Problems in the Operational Prediction of the Ocean Environment", A Century of Weather Progress, Lancaster Press, Lancaster, Pennsylvania, 1970, pp.105-120.

"Synoptic Analyses and Prediction of Conditions and Processes in the Surface Layers of the Sea" (co-author) Oceans from Space, Gulf Publishing Company, Houston, Texas, 1969, Chapter 10.

"Oceanographic Data Collection", Bulletin of the American Meteorological Society, Feb. 1968.

"Numerical Analysis of Sea Surface Temperature", International Journal of Oceanography and Terminology, Vol. 1, No. 4, 1968, pp. 277-290.

"Oceanographic Data Collection", Proceedings of the IBM Scientific Computing Symposium on Environmental Science, Thomas J. Watson Research Center, Yorktown Heights, N.Y., 1967.

"Ambient Thermal Noise in the Sea and the Instrumental and Observer Error and Biases of Sea Surface Temperature Measurements" (co-author) Proceedings of the Third U.S.N. Symposium on Military Oceanography, 1966, pp. 223-242.

"Numerical Environmental Prediction in the U.S. Navy", Travelers Research Seminar Series, 1965, Hartford, Conn.

"Solution of Naval Numerical Weather Problems (CDC 1604)", Proceedings of the 1960 Computer Applications Symposium, Armour Research Foundation, Illinois Institute of Technology.

"A Comparison of JNNP Trajectory Forecasts with Transosonde Flights" (co-author) Monthly Weather Review, Feb. 1958.

"The Error in Numerical Forecasts Due to Retrogression of Ultra-Long Waves", Monthly Weather Review, July 1958.

"The Prediction of Maritime Cyclones" (co-author) Journal of Meteorology, Vol. 15, 1958.

"The Prediction of Cyclone Intensity over the North Atlantic" (co-author) U.S. Navy, Bureau of Aeronautics Project AROWA Report, March 1955.

"Quantitative Determinations of Long Waves and Their Time Variations", Journal of Meteorology, December 1955.

"Cyclogenesis Along East Coast of Asia" (co-author) U.S. Navy, Bureau of Aeronautics Project AROWA Report, October 1953.

"Cyclogenesis over Southern European and Mediterranean Waters", U.S. Navy, Bureau of Aeronautics Project AROWA Report, November 1952.

AWARDS AND HONORS

Military Oceanography Award, Oceanographer of the Navy, 1969

Special Commendation, Marine Technology Society, 1968

Solberg Award, American Society of Naval Engineers, 1967

Commendation, Commander-in-Chief, Pacific Fleet, 1966

PROFESSIONAL AFFILIATIONS

American Meteorological Society

American Society of Naval Engineers

Phi Eta Sigma

Sigma Xi

KENNETH R. OSBORNE, II

Senior Associate

EDUCATION

Master of Science, Mathematics 1966
University of Arkansas

Bachelor of Science, Physics 1965
(with honors)
University of Arkansas

PROFESSIONAL EXPERIENCE

Mr. Osborne is a computer application system designer and programmer with over seven years' experience. He has focused on the development of real-time and signal processing systems. He has utilized both assembly and FORTRAN compiler level languages in IBM 360, CDC 6000 series and TI 980 computer operating environments.

Ocean Data Systems, Inc., Rockville, Maryland, 1972 - Present

Mr. Osborne is a member of the technical staff. He is principally concerned with the design and development of environmental models and signal enhancement processing systems, with particular attention to oceanographic and atmospheric interactions.

Texas Instruments, Inc., 1966 - 1972

Mr. Osborne was a member of the technical staff in the capacity of a computer system applications analyst. In this role, he was assigned lead technical and management responsibilities for a series of projects including his roles as:

Program manager from 1971 through 1972 of the station processor software modifications contract. This work involved significant system and application software upgrade development for a real-time data acquisition and signal enhancement processor system utilizing dual TI 980 mini-computers. In addition to software development, the project involved field operational software implementation and operational site data analysis. All programming was at the assembly language level. Signal enhance-

mant processing utilized time domain Widrow adaptive multi-channel filtering.

Task manager from 1970 through 1971 for Project Caesar field assignment at the Fleet Numerical Weather Central. This work involved the software design, development and implementation of a non-real-time simulator for marine acoustic signal enhancement processing on the CDC 6500 computer system. Signal enhancement processing utilized frequency domain Weiner multi-channel filtering. Software was primarily in FORTRAN Extended, with some COMPASS assembly language optimization. Additional responsibilities included organization and direction of production data processing for the task effort.

Task manager from 1969 through 1970 for the Vela uniform field assignment at the Seismic Array Analysis Center, Washington, D.C. Activities included the software design of an LP array real-time data acquisition system implemented on an IBM S/360 Mod 40 computer in assembly language (ALC) under DOS. Primary responsibilities comprised the design, development and implementation of a non-real-time LP seismic signal enhancement and array evaluation system of programs. Analytical techniques included Wiener multi-channel filtering, coherence and directional spectra. Off-line processing software was primarily written in FORTRAN IV, with assembly language optimization.

Task manager from 1968 through 1969 for Project Caesar field assignment at Fleet Numerical Weather Central. Primary responsibilities included software development and data processing for a feasibility study of marine acoustic signal processing using a CDC 6500 computer.

Applications programmer analyst from 1966 through 1968 for Science Services Division for Geosciences. Experience included earth and marine signal processing, software development and management forecast programming. Work was performed utilizing IBM 360/50 and 360/65 computers under OS.

VINCENT WAYLAND

Systems Analyst

EDUCATION

Master of Science, Mechanical Engineering 1969
New Mexico State University

Program Design Training Program Certificate 1966
Bell Telephone Laboratories, Inc.

Bachelor of Science, Mathematics 1963
New Mexico State University

PROFESSIONAL EXPERIENCE

Mr. Wayland has over ten years' experience in computer science and systems programming. The majority of his experience has been in the application of super computers to the solution of large-scale weather and radar data processing problems. He has also worked in the area of computer language design and processor implementation.

Ocean Data Systems, Inc., Rockville, Maryland, 1973 - present

Mr. Wayland is a systems analyst. His primary responsibilities have been the conversion of a large weather model to the CDC 7700 and STAR-100 computers. These conversions involved modifying Control Data Corp.'s standard software products and model-splitting techniques developed by Ocean Data Systems, Inc. personnel.

National Center for Atmospheric Research, Boulder, Colorado, 1971 - 1973

Mr. Wayland was employed as a systems programmer by the National Center for Atmospheric Research. While there, he was active in increasing the usefulness of the CDC 7600 computer for application programs. He implemented a recovery scheme to restore I/O and roll-out files across CDC 7600 hardware failures. He also designed a random access file subroutine to enable transparent usage of the CDC 7600 large core memory, thus enabling programs to run without modification on either the CDC 6600 or 7600 computers.

Mr. Wayland also worked in the areas of simulation and performance measurement. He simulated a remote entry batch

figuration and has implemented software probes to gather software and hardware performance data. In working with language processors, he enhanced the NCAR assembler and assisted in the maintenance of the FORTRAN compiler and object-time library. He also serves as an alternate delegate to the American National Standards Institute committee on FORTRAN standardization, X3J3.

Control Data Corporation, St. Paul, Minnesota, 1970 - 1971

Mr. Wayland was a senior applications analyst while serving as a group leader. He was in charge of the process construction and languages group within the Operating Systems Department of the Advanced Studies Division. This group was to define and implement a process construction language for the STAR-100 computer under a study contract from the Advanced Ballistic Missile Defense Agency.

Control Data Corporation, Boulder, Colorado, 1967 - 1970

Mr. Wayland was assigned as an on-site analyst to the National Center for Atmospheric Research. In this capacity, he was active in Control Data Corp.'s benchmark effort of the CDC 7600, which was in competition with the IBM 360/195. This benchmark effort involved the conversion to Control Data FORTRAN from NCAR FORTRAN of the source code and modifying Control Data Corp.'s standard 7600 operating system. Prior to this, Mr. Wayland had assisted in the implementation of NCAR designed operating system, FORTRAN compiler and assembler. He rewrote the assembler for a one hundred percent assembly rate improvement and added a symbolic cross reference dictionary and other features.

Programming Services, Inc., Phoenix, Arizona, 1966 - 1967

While employed as a consultant, Mr. Wayland was coresponsible for the design and implementation of an acceptance test and diagnostic program for a drum memory subsystem. This work was done under contract to General Electric Computers for the GE 400 computer line.

Bell Telephone Laboratories, Inc., White Sands Missile Range, New Mexico, 1963 - 1966

As a member of the technical staff, Mr. Wayland was responsible for the implementation of a real-time aircraft control program. This program was to precisely control an airplane for the antenna pattern measurements test of the MAR I phased array radar. He also had responsibility for

the primary data reduction program for the Target Tracking Radar. During his employment there, Mr. Wayland also participated in the program design training program and did miscellaneous applications and systems programming.

Department of the Army, White Sands Missile Range, New Mexico, 1963

Mr. Wayland was employed by the Army as a mathematician. As such, he did programming for statistical studies of the comparative accuracies and precisions of the various missile tracking systems. He also instructed a basic mathematics refresher course.

PUBLICATIONS

"ASCENT Reference Manual" (co-author) NCAR Technical Note, National Center for Atmospheric Research, November 1973.

"Computing Facility Publications", Atmospheric Technology, No. 3, September 1973, pp. 28-30.

"Longitudinal Vibrations of a Bar Having a Variable Modulus of Elasticity", Master's Thesis, New Mexico State University, June 1969.

AWARDS AND HONORS

NCAR Technology Advancement Award (shared by Systems Programming Group) for development of the NCAR operating system and FORTRAN compiler, 1972

PROFESSIONAL AFFILIATIONS

Association for Computing Machinery
Special Interest Group Membership:
Special Interest Group on Programming Languages
Institute for Electrical and Electronic Engineers
IEEE Computer Society

WARREN S. YOGI

Computer Specialist

EDUCATION

Bachelor of Science, Geosciences 1968
University of Hawaii

PROFESSIONAL EXPERIENCE

Mr. Yogi has been programming on large scientific computers for eight years. His work includes data reduction and formatting, environmental modeling and simulation. His most recent work has been focused on typhoon forecasting and interactive CRT devices.

Ocean Data Systems, Inc., Rockville, Maryland, 1972 - present

Mr. Yogi has the major responsibility in the development, operation and maintenance of long-range acoustic models for the Office of Naval Research and Fleet Numerical Weather Central. He has also developed several complex post-processing programs to sort the huge volumes of acoustic results from the major models and present detailed summaries in a variety of graphical and tabular forms.

A major task was in support of a shipboard minicomputer with CRT, disk, cassettes and hardcopy, with a primary objective of acoustic prediction. By developing interactive plotting routines to display intermediate and final results, the system capability was greatly expanded. Also, a data-editing program was added to allow the operator to remove or correct errors in the data files.

He is also involved in improving typhoon forecasting for FWC Guam on their CDC 3100. Part of the current effort involves recomputing the correlation coefficients from the modified historical data file.

Mr. Yogi is presently working on a major project involving the development of a basic plotting package of computer-generated displays for a color monitor. Displays of three-dimensioned data and also movie-

sequence type display of a primitive equation forecast have been generated. Current work is being done on a ship routing display, where the forecast surface pressure field and wave heights are superimposed with the actual ship movements.

In addition, he is improving the computer code for two primitive equation models. One is the EPRF Hydrodynamical Numerical (HN) model to be operational on a CDC 3200 and the other is the NOAA atmospheric model modified for the CDC 7600. The objective for both is optimum run time with no loss in accuracy.

Another major task is the development of an interactive graphics driver for the FNWC 6500 with the Tektronix 4012 as the display output. Major features of the system include full line and character mode capabilities, windowing and blanking of selected areas, overlaying of selected areas, and modification of data fields by the operator.

Mr. Yogi has also developed a program to generate geographical backgrounds for any selected area for the NEDS graphics terminal. He has also a program that will scan the 6500 dayfile and display selected parameters on the on-line plotter in a compact but readable form. The result is a running analysis of the performance of the computer system in a vivid graphical form, rather than tables of printed summaries.

Office of Naval Research Liaison Officer for Acoustics, 1970 - 1972

While still in the Navy, Mr. Yogi was reassigned to the ONRL office to work on special acoustic projects, specifically in the field of long-range underwater acoustics. Heavy use of the electrostatic plotters was made during this period, primarily in displaying the loss versus range plots, but also in depicting the environmental parameters such as bottom topography, sound speed profiles and the still popular ray traces.

Some of the large programs were modified for the Lawrence Berkeley Laboratories' 7600 and extensive use of microfiche output as an alternative to printer paper was quite effective.

Fleet Numerical Weather Central, Monterey, California, 1968 - 1970

Mr. Yogi served in the United States Navy at Monterey, devoting his entire tour to improving some of the Navy's latest acoustic detection models. Initially, only Calcomp incremental drum plotters were available, but extensive use of these was made in producing ray tracings, sound loss plots, contour maps and various other visual displays which greatly aided the conception of new ideas in the various models. With the introduction of the Varian electrostatic plotters, Mr. Yogi assumed responsibility for a partially coded software package, optimized the existing code, added the missing sections and implemented the package for general use. These routines are being extensively used in all on-line plotting.

As a special project, Mr. Yogi endeavored to write and test a computer program that simulated the game of LIFE (Scientific American, September 1969) which was displayed on the left screen of the 6500 main console and was interactive with the operator. As this program tied up the main console, further development was not possible.

University of Hawaii, 1964 - 1968

Mr. Yogi's introduction to graphics was designing and implementing a general set of FORTRAN subroutines on the IBM 360/44 for a Benson-Lehner large table electroplotter, a 50" x 60" flatbed plotter with four programmable pens and an impact alphanumeric printer. These basic subroutines were then used in the applications programs in support of producing a data atlas for the 1963 - 64 International Indian Ocean Expedition. Extensive data point plotting and contouring was done on this system.

Other graphics were done on a small scale, with a Calcomp 565, an eleven-inch incremental drum plotter and with the IBM 2260, an interactive CRT for alphanumeric only.

FRANK J. RYAN

EDUCATION

Master of Science, Physics 1971
University of Washington

Bachelor of Science, Physics 1969
California Institute of Technology

PROFESSIONAL EXPERIENCE

Boeing Computer Services, Inc., Renton, Washington, 1973

Mr. Ryan was engaged in scientific applications programming and numerical analysis in support of aerodynamics research. He also dealt with efficiency optimization of large multi-program systems for the dynamic aeroelastic analysis of flexible aircraft and the development of a three-dimensional supersonic potential flow code for arbitrary shaped objects. Mr. Ryan designed a matrix package for the efficient storage and retrieval of large data sets and the out-of-core solution of non-deterministic systems of linear equations. He provided numerical quadrature solutions of singular integral equations arising in aerodynamics. This work was performed on a CDC 6600 with KRONOS operating system.

University of Washington, Seattle, Washington, 1970 - 1972

While employed in the Laboratory of Radiation Ecology, Mr. Ryan was a research assistant and a consultant in the areas of nuclear spectroscopy, statistical analysis and the application of activation analysis techniques to radiation ecology. He developed computer codes for the quantitative analysis of complex spectra from multi-channel, Ge(Li) detector systems. Previously, as a member of the theoretical physics group, Mr. Ryan conducted research in nuclear structure physics on potential energy surfaces of deformed nuclei using statistical models. He developed a new cartesian gaussian basis for use in deformed Hartree-Fock calculations and optimized multi-variable non-linear functionals. He also provided a numerical solution of the Schoedinger differential equations.

U.S. Naval Postgraduate School, Monterey, California, 1966 - 1969

Mr. Ryan was employed during the summers as a research

assistant in the experimental nuclear physics laboratory based around a 100 Mev electron linac. The areas of research included nuclear structure studies of light nuclei, radiation straggling and radiation damage to semi-conductors.

Mr. Ryan has had eight years of programming experience on a variety of machines, including IBM 360/75, 7094, 1130, CDC 6400, 6600,7600, PDP-5, 8, 10, Burroughs B-5500. He is proficient in FORTRAN, COMPASS, ALGOL and CITRAN programming languages.

PUBLICATIONS

Bull. Am. Phys. Soc. 17, p. 36 (co-author).

AWARDS AND HONORS

National Merit Scholar

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
875 NORTH RANDOLPH STREET
SUITE 1425
ARLINGTON VA 22203-1995

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MEMORANDUM FOR DISTRIBUTION LIST

Subj: DECLASSIFICATION OF LONG RANGE ACOUSTIC PROPAGATION PROJECT (LRAPP) DOCUMENTS

Ref: (a) SECNAVINST 5510.36

Encl: (1) List of DECLASSIFIED LRAPP Documents

1. In accordance with reference (a), a declassification review has been conducted on a number of classified LRAPP documents.

2. The LRAPP documents listed in enclosure (1) have been downgraded to UNCLASSIFIED and have been approved for public release. These documents should be remarked as follows:

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Declassified LRAPP Documents

Report Number	Personal Author	Title	Publication Source (Originator)	Pub. Date	Current Availability	Class.
WHOI73-59	Tollios, C. D.	THE ACODAC DATA PROCESSING SYSTEM	Woods Hole Oceanographic Institution	730901	AD0773114; ND	U
Unavailable	Russell, J. J.	DOCUMENTATION FOR COMPUTER PROGRAM SUMMARY: A COMPUTER PROGRAM TO SUMMARIZE SOUND SPEED PROFILE DATA	Naval Undersea Center	731001	AD0918907	U
MC001Vol2	Unavailable	CHURCH ANCHOR DATA ANALYSIS PLAN VOL 2 (U)	Maury Center for Ocean Science	731001	ND	U
73-9M7-VERAY-R2	Jones, C. H.	LRAPP VERTICAL ARRAY- PHASE III	Westinghouse Research Laboratories	731105	ADA001130; ND	U
55	Weinstein, M. S., et al.	SUS QUALITY ASSESSMENT	Underwater Systems, Inc.	731201	AD785875 ND	U
ARL-TM-73-42	Mitchell, S. K., et al.	QUALITY CONTROL ANALYSIS OF SUS PROCESSING FROM ACODAC DATA	University of Texas, Applied Research Laboratories	731220	ADB000293 ND	U
Unavailable	Daubin, S. C.	CHURCH GABBRO TECHNICAL NOTE: CONTINUOUS CURRENT PROFILES	University of Miami, Rosenstiel School of Marine and Atmospheric Science	740101	AD0775333	U
Unavailable	Bitterman, D. S.	ACODAC AMBIENT NOISE SYSTEM	Woods Hole Oceanographic Institution	740101	ADA009440	U
ONR MC-002 VOL. 2; XONICS 885	Unavailable	LONG RANGE ACOUSTIC PROPAGATION PROJECT (LRAPP). SQUARE DEAL DATA ANALYSIS PLAN (U) VOLUME 2 - ANNEXES	Maury Center for Ocean Science; Xonics, Inc.	740101	ND	U
ARL-TM-74-12	Groman, R. O., et al.	SPECIAL HARDWARE FOR ARL ANALYSIS OF ACODAC DATA	University of Texas, Applied Research Laboratories	740314	ADA000295; ND	U
Unavailable	Unavailable	ASEPS NEAR FIELD TRANSMISSION LOSS MODIFICATION, P-2205	Ocean Data Systems, Inc.	740401	ADA096583	U
Report 001; MSAG-1	Unavailable	MEASUREMENT SYSTEMS ADVISORY GROUP	Office of Naval Research	740401	ADA096586; ND	U
ACR-196	Gregory, J. B.	PROJECT PACIFIC SEA SPIDER, TECHNOLOGY USED IN DEVELOPING A DEEP-OCEAN ULTRASTABLE PLATFORM	Office of Naval Research	740412	AD0529945; ND	U
Unavailable	Gottwald, J. T.	ANNUAL REPORT FOR 1 MAY 1973 - 30 APRIL 1974	Tracor, Inc.	740524	AD0920210	U
Unavailable	Unavailable	ACOUSTIC MODEL SUPPORT ACTIVITIES, P-2220	Ocean Data Systems, Inc.	740530	ADA096584	U
HCI-CMC-18540	Daubin, S. C.	TRANSMISSION LOSS OF LOW FREQUENCY UNDERWATER SOUND IN THE CAYMAN TROUGH (CHURCH GABBRO TECHNICAL NOTE)	University of Miami, Rosenstiel School of Marine and Atmospheric Science	740601	ADC000424; ND	U
HCI-CMC-18343	Daubin, S. C.	AMBIENT NOISE IN THE NORTHWEST CARIBBEAN SEA (CHURCH GABBRO TECHNICAL NOTE) (U)	University of Miami, Rosenstiel School of Marine and Atmospheric Science	740601	ND	U
Unavailable	Barnes, A., et al.	DISCRETE SHIPPING MODEL	Planning Systems, Inc.	740604	ND	U

ENCL (1)